Indicator: Birth Defect Mortality and Incidence (096 and 097)

Congenital anomalies, or birth defects, are structural defects that are present in the fetus at birth. Although birth defects are the leading cause of infant mortality (deaths occurring to those <1 year of age) in the United States, the cause is unknown for approximately 70% of all cases (CDC, 2005). Many different factors are associated with the development of birth defects such as genetic and/or chromosomal aberrations, exposure to viruses or bacteria, uncontrolled diabetes, cigarette smoke, use of drugs and alcohol during pregnancy, and prenatal exposure to dangerous chemicals in the workplace or pollutants in the environment. All of these factors can change normal infant growth or development resulting in different types of birth defects (NICHD, 2005).

This indicator presents birth defects mortality and incidence among infants in the United States as recorded in the National Vital Statistics System (NVSS) which registers virtually all deaths and births nationwide. The temporal coverage of the data is from 1933 to present and data are collected from all 50 States and the District of Columbia. Birth defects are recorded on the Birth Certificate for 49 States and the District of Columbia with coverage of 99% of all births within the United States.

What the Data Show

Birth defects continue to be the leading cause of infant mortality, accounting for 5,623 (20%) of the 28,034 infant deaths in 2002 (Figure 090-2). Figure 096 presents the overall trends in birth defects mortality (<1 year of age) on the National scale for the time periods of 1979-1998 and 1999-2001. Between 1979 to 1998 a decline in the National birth defects mortality rate has been observed ranging from 255.4 per 100,000 live births in 1979 to 157.6 per 100,000 in 1998. The continuation of this trend starting in 1999 is uncertain. In 2001, the birth defect mortality rate was 136.9 per 100,000 infants (Figure 096). The most frequently occurring types of birth defects were other musculoskeletal/integumental anomalies, other circulatory/respiratory system anomalies, and heart malformations (Table 097 Birth Defects Incidence).

Figure 096 presents the overall trends in birth defects mortality (<1 year of age) for the 10 EPA Regions for the time periods 1979-1998 and 1999-2001. Overall birth defects mortality rates among the 10 EPA Regions have been declining during the years 1979-1998 where the range in rates in 1979 was 234.3 (Region 8) to 270.8 (Region 10) per 100,000 and in 1998 121.1 (Region 1) to 182.8 (Region 8) per 100,000. The rates in 2001 were a high of 152.1 per 100,000 to a low of 82.9 per 100,000.

Birth defect mortality has been reported to be higher among Black compared to White infants. In 2001, the rate among Black male and female infants was 174.4 and 165.9 per 100,000 infants, respectively, and among White male and female infants was 141.6 and 125.4 per 100,000 infants, respectively.

Indicator Limitations

- Congenital anomalies are reported on the birth certificates of 49 States and the District of Columbia.

- Birth defects mortality rates are based on underlying cause-of-death as entered on a death certificate by a physician. Some individuals may have had competing causes of death. “When more than one cause or condition is entered by the physician, the underlying cause is determined by the sequence of conditions on the certificate, provisions of the ICD, and associated selection rules and modifications” (CDC WONDER). Consequently, some misclassification of reported mortality might occur in individuals with competing causes of death.

- Because some birth defects are not recognized immediately, they are often underreported on both the death and birth certificates (Friis and Sellers, 1999).

- Caution should be used in comparing yearly rates for a specific anomaly as a small change in the number of anomalies reported can result in a relatively large change in rates.

- The International Classification of Diseases 9th Revision (ICD-9) codes were used to specify underlying cause of death for years 1979 - 1998. Beginning in 1999, cause of death is specified with the International Classification of Diseases 10th Revision (ICD-10) codes. The two revisions differ substantially, and to prevent confusion about the significance of any specific disease code, data queries are separate. The relatively large difference between birth defect mortality rates reported between 1979—1998 and those reported beginning in 1999 may be due to some changes in the criteria used to report birth defect mortality during the switch from ICD-9 to ICD-10.

Data Sources

Mortality:
CDC. CDC WONDER. Compressed Mortality File, Underlying Cause of Death. http://wonder.cdc.gov. The complete web-link pathway from the CDC WONDER Home Page is:
-> Mortality—underlying cause of death -> Mortality for 1999–2001 with ICD 10 codes (age range = <364 days). Note: ICD-9 codes 740-759; ICD-10 codes Q00–Q99 congenital malformations, deformations, and chromosomal abnormalities

The raw numbers for each state were downloaded from the CDC WONDER mortality database (http://wonder.cdc.gov). The raw numbers for each state within a region were combined and age-adjusted rates (2000 U.S. Standard Population) were calculated.

National Center for Health Statistics. 2004. Deaths: Final Data for 2002. National Vital Statistics Reports. 53(5). http://www.cdc.gov/nchs/data/nvsr/nvsr53/nvsr53_05.pdf.

Incidence:
National Center for Health Statistics. 2001. Births Final Data for 1999. National Vital Statistics Reports. 49(1). http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_01.pdf see Table 49.

National Center for Health Statistics. 2002. Births Final Data for 2000. National Vital Statistics Reports. 50(5). http://www.cdc.gov/nchs/data/nvsr/nvsr50/nvsr50_05.pdf see Table 49.

National Center for Health Statistics. 2002. Births Final Data for 2001. National Vital Statistics Reports. 51(2). http://www.cdc.gov/nchs/data/nvsr/nvsr51/nvsr51_02.pdf see Table 49.

National Center for Health Statistics. 2003. Births Final Data for 2002. National Vital Statistics Reports. 52(10). http://www.cdc.gov/nchs/data/nvsr/nvsr52/nvsr52_10.pdf see Table 49.

References

Centers for Disease Control and Prevention (CDC). 2005. Birth Defects. (Last Accessed February 7, 2005) http://www.cdc.gov/ncbddd/bd/

Friis, RH and Sellers TA. 1999. Epidemiology for Public Health Practice, Second Edition. Gaithersburg, MD: Aspen Publishers, Inc.

National Institute of Child Health & Human Development (NICHD). 2005. Birth Defects and Human Development. Accessed February 3, 2005. http://www.nichd.nih.gov/about/womenhealth/birth_defects.cfm

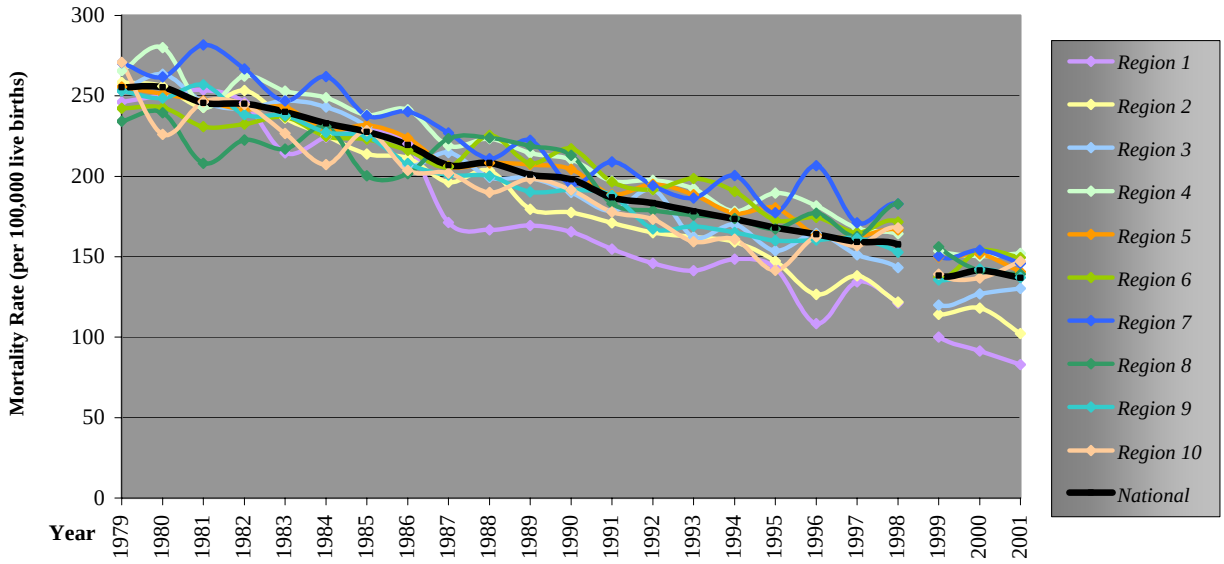
Graphics

Figure 090-2. Leading Causes of Infant Death, 2002

Cause of Death	Number of Deaths	Percentages
Congenital malformations, deformations, and chromosomal abnormalities	5,623	20.1
Disorders related to short gestation and low birthweight	4,637	16.5
Sudden Infant Death Syndrome (SIDS)	2,295	8.2
Newborn affected by maternal complications of pregnancy	1,708	6.1
Newborn affected by complications of placenta, cord, and membranes	1,028	3.7
Accidents (Unintentional Injuries)	943	3.4
Respiratory distress of newborn	946	3.4
Bacterial sepsis of newborn	749	2.7
Diseases of the circulatory system	667	2.4
Intrauterine hypoxia and birth asphyxia	583	2.1
All Other Causes	8,855	31.6

Source: National Center For Health Statistics (NCHS). 2004. Deaths Final Data 2002. National Vital Statistics Vol. 53 No. 5. http://www.cdc.gov/nchs/data/nvsr53/nvsr53_05.pdf. See Table E.

Figure 096. U.S. Birth Defects Mortality Rates (<1 Year of age), total U.S. and 10 EPA Regions, 1979-2001*



* - Due to differences in the ICD system used for classifying mortalities, data from 1979-1998 should not be directly compared to data from 1999-2001.
ICD-9 CODES: 740-759 (1979-1998); ICD-10 CODES: Q00-Q99 (1999-2001)

Table 097Birth Defects Incidence. Rate of Live Births with Specific Birth Defect (Congenital Anomaly), United States, 1999-2002[1]

Congenital Anomaly	1999	2000	2001	2002
Anencephalus	11.0	10.7	9.9	9.9
Spina bifida/Meningocele	20.1	20.7	19.9	20.0
Hydrocephalus	21.5	23.7	22.5	22.5
Microcephalus	5.9	7.2	5.6	5.5
Other central nervous system anomalies	20.0	20.7	24.8	22.2
Heart malformations	119.8	124.9	122.5	129.9
Other circulatory/respiratory anomalies	140.6	138.1	139.6	131.7
Rectal atresia/stenosis	9.0	8.4	9.0	8.3
Tracheo-esophageal fistula/Esophageal atresia	13.3	12.1	12.0	10.8
Omphalocele/Gastroschisis	30.2	29.7	31.8	30.3
Other gastrointestinal anomalies	29.8	29.9	34.2	36.1
Malformed genitalia	76.3	84.2	88.4	86.6
Renal agenesis	13.7	13.8	14.8	15.4
Other urogenital anomalies	99.0	99.3	102.8	101.8
Cleft lip/palate	80.9	82.1	80.6	78.5
Polydactyly/Syndactyly/Adactyly	87.9	87.2	82.4	82.2
Clubfoot	55.7	57.2	58.6	59.6
Diaphragmatic hernia	13.1	10.8	11.4	12.1
Other musculoskeletal/integumental anomalies	239.9	217.0	226.4	228.9
Down's syndrome	45.5	46.9	45.5	46.7
Other chromosomal anomalies	36.9	39.7	36.2	31.6

[1] Note: Rates are per 100,000 live births

Source : National Center for Health Statistics. 2001. Births Final Data for 1999. National Vital Statistics Reports; vol 49 no.1 http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_01.pdf see Table 49

National Center for Health Statistics. 2002. Births Final Data for 2000. National Vital Statistics Reports; vol 50 no. 5 http://www.cdc.gov/nchs/data/nvsr/nvsr50/nvsr50_05.pdf see Table 49

National Center for Health Statistics. 2002. Births Final Data for 2001. National Vital Statistics Reports; vol 51 no.2 http://www.cdc.gov/nchs/data/nvsr/nvsr51/nvsr51_02.pdf see Table 49

National Center for Health Statistics. 2003. Births Final Data for 2002. National Vital Statistics Reports; vol 52 no.10 http://www.cdc.gov/nchs/data/nvsr/nvsr52/nvsr52_10.pdf see Table 49

R.O.E. Indicator QA/QC

Data Set Name: BIRTH DEFECTS INCIDENCE AND MORTALITY
Indicator Number: 096 (89097)
Data Set Source: CDC, NCHS
Data Collection Date: ongoing
Data Collection Frequency: yearly
Data Set Description: Birth Defects Incidence and Mortality (combines 096 & 097)
Primary ROE Question: What are the trends in human disease and conditions for which environmental pollutants are thought to be to risk factors including across population subgroups and geographic regions?

Question/Response

T1Q1 Are the physical, chemical, or biological measurements upon which this indicator is based widely accepted as scientifically and technically valid?

Yes. The National Vital Statistics System (NVSS) is the oldest and most successful example of inter-governmental data sharing in Public Health and the shared relationships, standards, and procedures form the mechanism by which NCHS collects and disseminates the Nation's official vital statistics. The methodology for collecting vital statistics is standardized and outlined in "Model State Vital Statistics Act and Regulations" Revised April 1995, DHHS publication (PHS) 95-1115 (http://www.cdc.gov/nchs/data/misc/mvsact92aacc.pdf)

T1Q2 Is the sampling design and/or monitoring plan used to collect the data over time and space based on sound scientific principles?

Yes. The National Vital Statistics System is responsible for the Nation s official vital statistics. These vital statistics are provided through State-operated registration systems. Standard forms for the collection of data and model procedures for the uniform registration of the events are developed and recommended for State use through cooperative activities of the States and the NCHS (http://www.cdc.gov/nchs/data/dvs/DEATH11-03final-ACC.pdf). U.S. Standard Death Certificates are revised periodically. Most state certificates conform closely in content and arrangement to the standard certificate recommended by NCHS and all certificates contain a minimum data set specified by NCHS. Demographic information on the death certificate is provided by the funeral director based on information supplied by an informant. A physician, medical examiner, or coroner provides medical certification of cause of death. U.S. Standard Birth Certificates are revised periodically. Most state certificates conform closely in content and arrangement to the standard certificate recommended by NCHS and all certificates contain a minimum data set specified by NCHS. One section of the Standard Birth Certificate is reserved for congenital abnormalities.

T1Q3 Is the conceptual model used to transform these measurements into an indicator widely accepted as a scientifically sound representation of the phenomenon it indicates?

Yes. The data collected by NVSS are routinely referenced and used in epidemiological studies.

T2Q1 To what extent is the indicator sampling design and monitoring plan appropriate for answering the relevant question in the ROE?

Virtually all deaths are registered with the NVSS nationwide. The temporal coverage of the data is from 1933 to present. Data are collected from all 50 States including the District of Columbia.

Virtually all births are registered with the NVSS nationwide. The temporal coverage of the data is from 1933 to present. Data are collected from all 50 States including the District of Columbia. Birth defects is recorded on the Birth Certificate for 49 States and the District of Columbia with coverage of 99% of all births within the United States.

T2Q2 To what extent does the sampling design represent sensitive populations or ecosystems?

The data set has nationwide death reporting, including sensitive populations.

T2Q3 Are there established reference points, thresholds or ranges of values for this indicator that unambiguously reflect the state of the environment?

Not applicable

T3Q1 What documentation clearly and completely describes the underlying sampling and analytical procedures used?

The sampling and quality assurance information can be found in Model State Vital Statistics Act and Regulations Revised April 1995, DHHS publication (PHS) 95-1115 (http://www.cdc.gov/nchs/data/misc/mvsact92aacc.pdf). Documentation is also available at http://wonder.cdc.gov/wonder/help/mort.html Data source for Table HH3: Mortality: CDC. CDC WONDER. Compressed Mortality File, Underlying Cause of Death. http://wonder.cdc.gov. The complete web-link pathway from the CDC WONDER Home Page is: à Mortality underlying cause of death à Mortality for 1999 2001 with ICD 10 codes (age range <=364 days). Note: ICD codes Q00 Q99 congenital malformations, deformations, and chromosomal abnormalities Incidence: National Center for Health Statistics. 2001. Births Final Data for 1999. National Vital Statistics Reports; vol 49 no.1 http://www.cdc.gov/nchs/data/nvsr/nvsr49/nvsr49_01.pdf see Table 49 National Center for Health Statistics. 2002. Births Final Data for 2000. National Vital Statistics Reports; vol 50 no. 5 http://www.cdc.gov/nchs/data/nvsr/nvsr50/nvsr50_05.pdf see Table 49 National Center for Health Statistics. 2002. Births Final Data for 2001. National Vital Statistics Reports; vol 51 no.2 http://www.cdc.gov/nchs/data/nvsr/nvsr51/nvsr51_02.pdf see Table 49 National Center for Health Statistics. 2003. Births Final Data for 2002. National Vital Statistics Reports; vol 52 no.10 http://www.cdc.gov/nchs/data/nvsr/nvsr52/nvsr52_10.pdf see Table 49

T3Q2 Is the complete data set accessible, including metadata, data-dictionaries and embedded definitions or are there confidentiality issues that may limit accessibility to the complete data set?

The data can be accessed up to the county level through the electronic data warehouse for CDC at http://wonder.cdc.gov/nataJ.html. Individual level data are not available due to confidentiality issues.

T3Q3 Are the descriptions of the study or survey design clear, complete and sufficient to enable the study or survey to be reproduced?

Yes. Virtually all deaths from the 50 states, including District of Columbia, submit mortality data to the NVSS at NCHS. The recommended certificate of death is posted at http://www.cdc.gov/nchs/data/dvs/DEATH11-03final-ACC.pdf. The documentation for the mortality data set is http://wonder.cdc.gov/wonder/help/mort.html. Yes. Virtually all births from the 50 states, including District of Columbia, submit birth data to the NVSS at NCHS. The

recommended birth certificate is posted at http://www.cdc.gov/nchs/data/dvs/birth11-03final-ACC.pdf. The documentation for the birth set is at http://wonder.cdc.gov/wonder/help/nata.html.

T3Q4 To what extent are the procedures for quality assurance and quality control of the data documented and accessible?

See answer to T3Q1

T4Q1 Have appropriate statistical methods been used to generalize or portray data beyond the time or spatial locations where measurements were made (e.g., statistical survey inference, no generalization is possible)?

Not applicable, data represent all births and deaths.

T4Q2 Are uncertainty measurements or estimates available for the indicator and/or the underlying data set?

Not applicable

T4Q3 Do the uncertainty and variability impact the conclusions that can be inferred from the data and the utility of the indicator?

Not applicable

T4Q4 Are there limitations, or gaps in the data that may mislead a user about fundamental trends in the indicator over space or time period for which data are available?

Because some birth defects are not recognized immediately, they are underreported on both the death and birth certificates. Caution should be used in comparing yearly rates for a specific anomaly as a small change in the number of anomalies reported can result in a relatively large change in rates. The mortality data on the Compressed Mortality File at http://wonder.cdc.gov/mortSQL.html are based on records for all deaths occurring in the fifty states and the District of Columbia. Deaths to foreign residents are excluded. Deaths to residents who died abroad are not included on this file. For purposes of comparison, it should be noted that mortality rates reported by NCHS reports differ slightly from those rates reported by CDC WONDER. NCHS uses U.S. Census Bureau population estimates for all age groups; CDC WONDER uses birth certificate data for the Under 1 Year age group and uses U.S. Census Bureau population estimates for all other age groups. The International Classification of Diseases 9th Revision (ICD 9) codes are used to specify underlying cause of death for years 1979 - 1998. Beginning in 1999, cause of death is specified with the International Classification of Diseases 10th Revision (ICD 10) codes. The two revisions differ substantially, and to prevent confusion about the significance of any specific disease code, data queries are separate. Regional data: Mortality data are not available for the U.S. territories in CDC WONDER. Thus, Regions 2 and 9 are calculated to include only States. Note that for the years 1979, 1981-1989, and 2001, if the user selects a WONDER query for the United States with data grouped by state, or selects a WONDER query for a specific state, WONDER reports state population figures that do not add up to the national population reported by WONDER. This is because the two different sets of populations come from different U.S. Census population estimates. (For all other years, these two sets of population data are the same.) Congenital anomalies are reported on the birth certificates of 49 States and the District of Columbia.

Calculation of Age-Adjusted Regional Mortality Rates Using State Data from CDC WONDER

Mortality rates age-adjusted for the 2000 U.S. standard population (rates per 100,000) for the years 1979 through 2001 were compiled as detailed below. (Mortality data for 2002 and later are not yet available through CDC WONDER.)

Identifying relevant data

- Each mortality indicator (e.g., cancer, cardiovascular disease, asthma) was reviewed based on EPA's 2003 Draft Report on the Environment and a National Center for Health Statistics (NCHS) report that discusses ICD (International Classification of Diseases) to obtain the ICD codes that describe each of these indicators. Due to a revision of the ICD system in 1999, ICD-9 codes were obtained for the years 1979-1998 and ICD-10 codes for the years 1999-2001.

Downloading and organizing the data

- Mortality data were accessed through CDC's WONDER database (http://wonder.cdc.gov/).

- We downloaded a file for each year that regional mortality indicators were requested (1979-2001) and saved these data into separate sheets in Microsoft Excel (one workbook for each indicator). Both raw and compiled data are presented in each of these Excel workbooks. For example, '1999D' is the sheet with the raw data for the year 1999 and '1999' is the sheet with the calculations for that year.

- The calculation worksheet is organized as follows:

    - The first table arranges the raw data by state and age group. For each age group and state, two numbers are presented: the mortality cases and the associated population.

    - The second table (Regional Breakdown) groups the mortality cases and populations for the 50 states plus Washington, D.C., into the ten EPA regions, to obtain the total cases and total population for each region, by age group. (For a map of the EPA regions, refer to http://www.epa.gov/epahome/whereyou-live.htm.)

    - The third table (Regional Breakdown [combine certain groups]) merges two sets of age groups with each other (5-9 years with 10-14 years; 15-19 years with 20-24 years) to match the age-adjustment methodology used to calculate age-adjusted mortality rates in CDC WONDER (see below).

    - The fourth table on the worksheet (Regional Breakdown [Computation of Age-Adjusted Rate Components]) presents the basic steps of calculating age-adjusted mortality rates for each region (see below).

    - The final table on the Excel sheet (Regional Summary) lists the age-adjusted rates for each region and for the entire US; these values are compiled into the summary sheet

that covers all regions for all years for an indicator, accompanied by a trend chart that graphically depicts the regional data.

Calculating age-adjusted regional rates

The steps followed in calculating age-adjusted regional rates are detailed below, followed by a sample calculation.

Step 1

Using the following equation, the *crude death (or mortality) rate* is obtained by dividing the mortality cases ($Cases_i$) by the population for that age group ($Population_i$), then by multiplying by 100,000 (to get the cases per 100,000). This is done for each age group within each region. (The "i" subscript is included to indicate that this calculation is performed for several age groups, i.e. $CrudeRate_{<1\ year}$, $CrudeRate_{1\text{-}4\ years}$, etc.)

$$CrudeRate_i = \frac{Cases_i}{Population_i} \times 100{,}000$$

Step 2

For each age group, the weighted age-adjusted factor is calculated, using 2000 U.S. standard population factors provided by NCHS (See Table 1 below). The age-specific crude death rate is multiplied by that age group's standard population for the year 2000 ($2000\ Population_i$), and then divided by the total standard population for the year 2000 ($2000\ Population_{total}$). (For details on the standard population, see "Age-Adjustment of Death Rates" on the web page http://wonder.cdc.gov/wonder/help/mort.html[1]).

$$WeightedFactor = CrudeRate \times \frac{2000\,Population_i}{2000\,Population_{total}}$$

Table 1. United States Standard Population*

Age	Number
Under I year	13,818
1-4 years	55,317
5-14 years	145,565
15-24 years	138,646
25-34 years	135,573
35-44 years	162,613
45-54 years	134,834
55-64 years	87,247
65-74 years	66,037
75-84 years	44,842
85 years and over	15,508
All ages	1,000,000

* Based on year 2000 projected population

[1] The source cited by CDC WONDER for the age-adjustment data is the following NCHS report: *Anderson RN, Rosenberg HM. Age standardization of death rates: Implementation of the year 2000 standard. National Vital Statistics Reports; Vol 47 No 3. Hyattsville, Maryland. National Center for Health Statistics. 1998.*

Step 3

The age-adjusted mortality rate is then obtained by adding together the individual weighted factors for each age group:

$$AgeAdjustedRate = \sum_{i} WeightedFactor_i$$

Sample Calculation

Table 2 (below) shows the output of a sample calculation of the age-adjusted mortality rate for cancer (across all age groups) in EPA Region 9 in 1982. (Note that we have presented this in a format that is not used in the Excel workbook, in order to illustrate the calculations for a single region. However, all of the steps and calculations are identical.)

For each age group, the number of mortality cases is the sum of the mortality cases for Arizona, California, Hawaii, and Nevada, for that age group in that year; the population is the sum of the populations of these same four states for that age group in that year. For example, for the 35-44 years age group, the number of cancer mortalities for these states are 112 (Arizona), 1,413 (California), 53 (Hawaii), and 55 (Nevada), with the sum equaling 1,633. Similarly, the population is the sum of the respective states 338,654 (Arizona), 3,152,885 (California), 124,743 (Hawaii), and 120,463 (Nevada), which equals 3,736,745. The crude rate (43.70) for this age group is therefore equal to the total number of mortality cases (1,633) divided by the total population (3,736,745), multiplied by 100,000.

Table 1. Cancer Mortality, All Age Groups, EPA Region 9, 1982.

Age Group (Years)	Mortality Cases	Year 1982 Population	Crude Death Rate	2000 Std. Population	Weighted Factor
<1 year	32	515,809	6.20	13,818	0.09
1- 4 years	108	1,824,635	5.92	55,317	0.33
5- 9 years	114	1,977,487	N/A		
10-14 years	94	2,188,828	N/A		
5-14 years	208	4,166,315	4.99	145,565	0.73
15-19 years	139	2,432,939	N/A		
20-24 years	180	2,884,175	N/A		
15-24 years	319	5,317,114	6.00	138,646	0.83
25-34 years	694	5,551,792	12.50	135,573	1.69
35-44 years	1,633	3,736,745	43.70	162,613	7.11
45-54 years	4,662	2,793,603	166.88	134,834	22.50
55-64 years	11,283	2,679,802	421.04	87,247	36.73
65-74 years	15,423	1,876,606	821.86	66,037	54.27
75-84 years	11,397	912,865	1248.49	44,842	55.98
85+ years	4,424	269,593	1640.99	15,508	25.45
Unknown	27	0	N/A	0	0
Total	*50,210*	*29,644,879*	*N/A*	*1,000,000*	N/A
Age-Adjusted Mortality Rate					**205.7**

As described above, the Weighted Factor is the Crude Death Rate multiplied by the 2000 Standard Population for that age group and divided by the total Standard Population (the total of the age-group populations). For example, the weighted factor for the 35-44 years age group is the crude rate (43.70) times the 2000 population for that group (162,613), divided by the total 2000 Standard Population (1,000,000), which equals 7.11. The 1982 Region 9 age-adjusted mortality rate, 205.7, is the sum of the weighted factors of all age groups.

Notes:

- For the 5-14 and 15-24 years categories it is necessary to merge two sets of age ranges to match the age-adjustment grouping used within WONDER.

- For mortality indicators that were also compiled for children (ages 0-19 years), we only used the data for the age groups 0-1, 1-4, 5-9, 10-14, and 15-19 years, and then we age-adjusted these data using a set of age-adjustment factors that only cover to age 19 years.

- For the file that compiles birth defect mortality rates, the only data used from CDC WONDER are for the <1 year age group, so the crude rate equals the age-adjusted rate.

- Although data were queried for individual states to compile regional data, we did this by querying data for the entire United States from the CDC WONDER system, and specifying that the data be grouped by age and by year. Due to a quirk of CDC WONDER, if the user selects a single state for a query (instead of the entire United States), the population data are taken from a different data source: there are small discrepancies between these numbers and so the state-specific query should not be used to verify these compiled data.